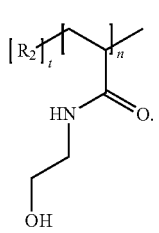
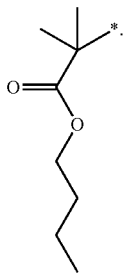
[0021] In some embodiments, the polymer has the structure of formula 4):



(4)

[0022] In formula (4), t is an integer of 50 to 90, n is an integer of 10 to 50, and R_2 is



[0023] In some embodiments, the polymer is a segmented polymer.

[0024] In some embodiments, the polymer is disposed on the substrate in manners such as coating, spraying, or impregnating. The substrate includes, but is not limited to, polypropylene, polyethylene terephthalate, cellulose, polybutylene terephthalate. Elements of the surface of the modified substrate comprise carbon, oxygen, and nitrogen; the total mole percentage of carbon, oxygen, and nitrogen is defined as 100%, the mole percentage of carbon is from about 76.22% to 79.84%, the mole percentage of oxygen is from about 18.1% to 21.04%, and the mole percentage of nitrogen is from about 2.05% to about 2.75%.

[0025] In some embodiments, the filtrate is subjected to DNA purification, and is analyzed by PCR, qPCR, digital PCR, NGS, MassSpec, or Nanopore sequencing.

[0026] In some embodiments, the filtrate is subjected to DNA purification, a sequencing library is constructed by Oxford Nanopore rapid library construction process. Then, sequencing is performed with Oxford Nanopore GridION sequencer.

[0027] In some embodiments, the biological samples is selected from the group consisting of blood, cerebral spinal fluid, cells, a cellular extract, a tissue sample, and a tissue biopsy.

[0028] In some embodiments, the method for enriching and detecting microorganisms in a biological sample according to the present invention can be used for pathogenic examination of biological samples.

[0029] In some embodiments, the invention also provides a device for enriching and detecting microorganisms in a biological sample. The device contains the following components: upper housing, filter, and lower housing. The filter is located between the upper housing and lower housing. The filter material contains the polymer-modified substrate as mentioned above; preferably, the filter is made from the polymer-modified substrate. The upper housing of the device may be provided with an inlet while the lower housing may be provided with an outlet. The biological sample enters the device from the inlet of the upper housing, penetrates through the filter, and flows out from the device through the outlet of the lower housing.

[0030] The method and device for enriching and detecting microorganisms in a biological sample provided by the present invention enable the sample to be filtered through the Sterile Acrodisc® White Blood Cell Syringe Filter (PALL) or polymer-modified substrate, which is highly specific in capturing or separating human-derived nucleated cells such as leukocytes. Besides, the microorganisms can pass through the Sterile Acrodisc® White Blood Cell Syringe Filter (PALL) or polymer-modified substrate into the filtrate, thus enriching the microorganisms (including bacteria, mycoplasmas, fungi, viruses, spores etc.) in the sample during the reduction of human-derived nucleated cells. This process can therefore reduce the interference of the human cells in pathogenic examination.

[0031] In some embodiments, the method and device for enriching and detecting microorganisms in a biological sample comprises diagnosing sepsis in the individual.

[0032] The term "capture" and grammatical variations thereof means that the human-derived nucleated cells in the sample contact with the surface of the above substrate, and are attracted by the hydrophobic interactions, hydrogen bonding, or electrostatic intermolecular forces between the substrate and the cells, causing various types of human-derived nucleated cells to adhere directly to the surface of the modified substrate. The small size cells including fibrinogens and platelets may be attached before other larger cells. These processes are defined as "capture" of human-derived nucleated cells.

[0033] The term "separation" and grammatical variations thereof refers to the separation of human-derived nucleated cells from a sample after passing the sample containing human-derived nucleated cells material used to separates them. It also means that the content of human-derived nucleated cells in the sample can be reduced, or even significantly reduce. The process allows the concentration of human-derived nucleated cells in the resulting filtrate to be less than the original nucleated cells-containing sample.

[0034] The expression "reduction of nucleated cells" and grammatical variations thereof is not intended to mean that all or substantially all nucleated cells are completely removed. Instead, it is used to broadly indicate that the cell count of human-derived nucleated cells is reduced during separation or filtration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] FIG. **1**: Schematic diagram of the process of the present invention for filtering a biological sample through a polymer-modified substrate.

[0036] FIG. **2**: The filtering device of the present invention for enriching and detecting microorganisms in a biological sample.

[0037] FIG. **3**: Structural formulas of the monomers and polymers of the present invention, as well as theoretically predicted values of chemical shifts of nuclear magnetic resonance (NMR) spectrum signals thereof.